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**GRILL FLAME (U)**  
**CLOSE HOLD/HAND CARRY**

28 September 1978

Proposal for Research

SRI No. ESU 78-100

**SPECIAL TRAINING TECHNIQUES (U)**

**Part One--Technical Proposal**

Prepared for:

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Copy No. 2

This document consists of 26 pages

SRI 8-4443

**GRILL FLAME (U)**  
**CLOSE HOLD/HAND CARRY**

Classification Determination Pending  
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## I INTRODUCTION

Recent publications provide mounting evidence for the existence of so-called parapsychological or paraphysical processes. These processes are taken to include the following:

- (1) The acquisition and description, by mental means, of information blocked from ordinary perception by distance or shielding and generally believed to be secure against such access.
- (2) The production of physical effects such as the perturbation of instrumentation or equipment that appears to be well shielded against, or otherwise inaccessible to, human influence.

The literature also indicates evidence of an acceleration of research in both Western and Soviet Bloc countries in an effort to precipitate a breakthrough. In the West, a large-scale exploratory research effort on psychoenergetic channels has been carried out by the authors in the Electronics and Bioengineering Laboratory and the Radio Physics Laboratory of SRI International. Our work dealt primarily with a human information-accessing capability that we call "remote viewing." This phenomenon pertains to the ability of certain individuals to access and describe, by means of mental processes, remote geographical locations up to several thousand km distant from their physical location. In more than 50 experiments with roughly a dozen subjects, including government scientists sent to examine experimental protocols, significant results were obtained in the viewing of remote buildings, laboratory apparatus, and real-time activities. From this work we conclude that<sup>1-3\*</sup>

- (1) The phenomenon is not a sensitive function of distance over a range of several kilometers and is still operative over a range of several thousand kilometers.
- (2) Faraday cage electrical shielding does not appear to degrade the quality or accuracy of perception.
- (3) Most of the correct information pertains to shape, form, color, and material, rather than to function or name, suggesting that the function may be mediated primarily by the brain's right hemisphere.

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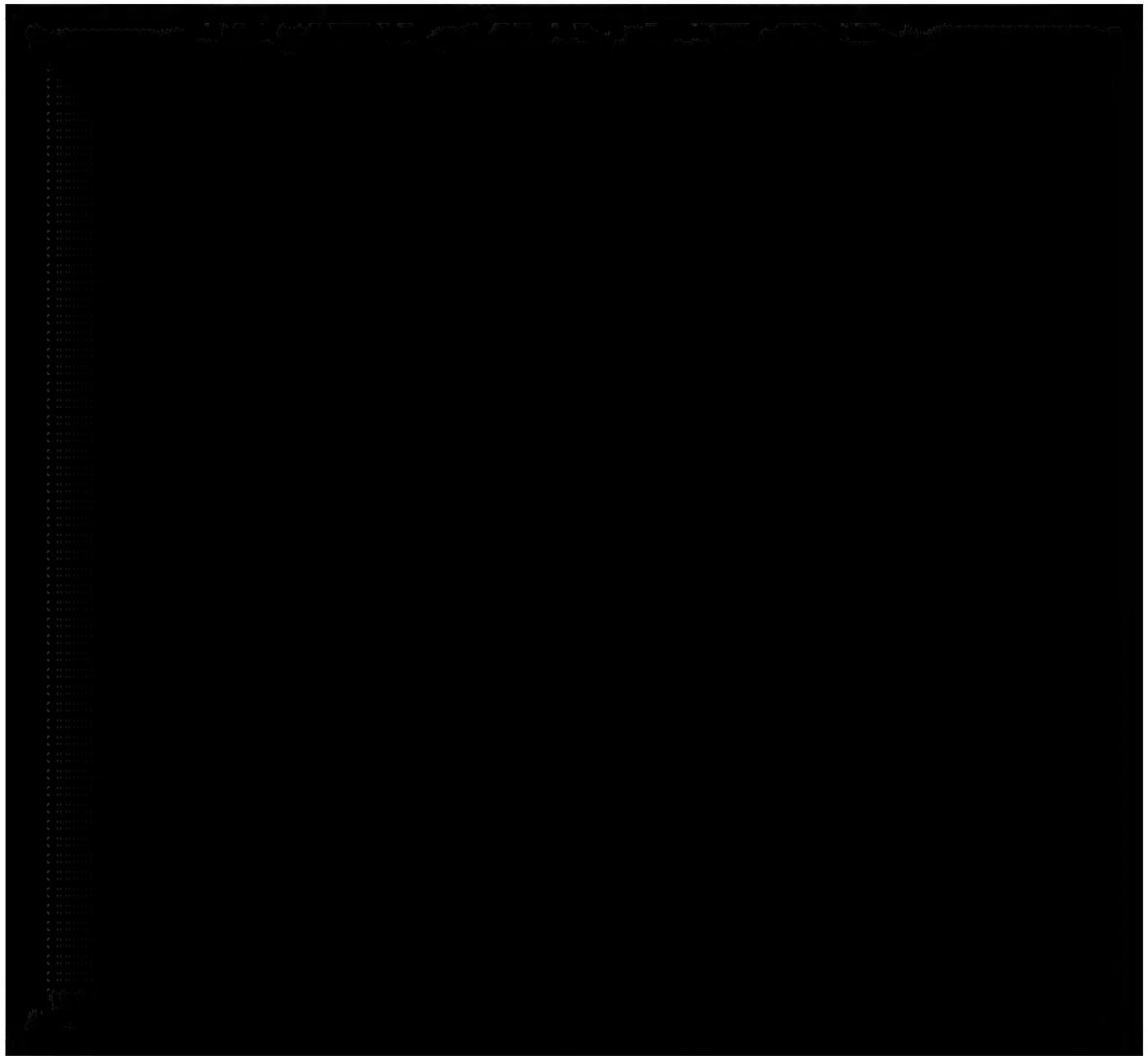
\*References are listed at the end of this document.

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- (4) The principal difference between experienced subjects and inexperienced volunteers is not that the latter do not exhibit the faculty but rather that their results are simply less reliable, indicating that remote viewing may be a latent and widely distributed, though suppressed, perceptual ability.
- (5) Subjects trained over a several-year period have shown improved performance under continuing experiments.

SG1B      (6) Clear evidence has been obtained showing that subjects in laboratory experiments can describe future events, not yet determined at the time of their description.

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Approved For Release 2000/08/07 : CIA-RDP96-00788R001100050001-5

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## II TECHNICAL APPROACH

With the overall objective of improving the reliability of psychoenergetic functioning, experimenters have attempted many different strategies, both to find more gifted subjects, and to provide the most optimal psychological environment for the subjects participating in experiments. In this section we will outline some of these approaches, with regard to special environments and methods for screening and training subjects.

A. Background

One of the most effective psychoenergetic protocols in terms of successful subject performance is the remote viewing of natural targets. As observed in the laboratory, the basic phenomenon appears to cover a range of subjective experiences variously referred to in the literature as autoscopy (in the medical literature); exteriorization or disassociation (psychological literature); simple clairvoyance, traveling clairvoyance, or out-of-body experience (parapsychological literature); or astral projection (occult literature). We choose the term "remote viewing" as a neutral descriptive term free from prior associations and bias as to mechanisms.

As carried out at SRI, the general protocol is to closet a subject with an experimenter and at a prearranged time to obtain from the subject a description of an undisclosed, remote site being visited by a target team, one of whose members is known to the subject and who thereby constitutes the target person. The target team is assigned their target location by an independent experimenter who has generated a list of targets located within a 30-minute driving time from SRI, and who accesses this list by a randomization procedure. The target pool consists of more than 100 target locations chosen from a target-rich environment. The target location selected is kept blind to both the subject and experimenter closeted at SRI. The experiment is thus of the double-blind type.

In detail: To begin an experiment, a subject is closeted with an experimenter at SRI and instructed to wait 30 minutes before beginning a narrative description of where the target team has gone. Meanwhile, the target team obtains sealed traveling orders from a monitor who has previously prepared and randomized a set of such orders. After leaving SRI by automobile, the target team opens the traveling orders and proceeds directly to the target without any communication with the subject or experimenter remaining at SRI. The experimenter remaining with the subject in the SRI laboratory is kept ignorant of both the particular

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target and the target pool so as to eliminate the possibility of cueing (overt or subliminal) and to allow him freedom in questioning the subject for clarification of his descriptions. The target team remains at the target site for a prearranged 15-minute period following the 30 minutes allotted for travel. During the observation period, the remote viewing subject at SRI is asked to describe his impressions of the target site into a tape recorder and to make any drawings he thinks appropriate. A tentative evaluation is made of the subject's output when the target team returns to SRI. Finally, following the experiment, the subject is taken to the site so that he may obtain direct feedback.

To obtain a first cut at a numerical evaluation of the accuracy of a series of, say,  $N$  remote viewing experiments, the experimental results are subjected to independent judging on a blind basis by SRI research analysts not otherwise associated with the research. The response packets, which contain nine typed, unedited transcripts\* of the tape-recorded narratives and associated drawings, are unlabeled and presented in random order. Working alone, an analyst visits a target location and in a blind fashion rates the subject's descriptions on a scale 1 to 9 (best to worst match). This procedure is repeated with different analysts for each target site. At the end, the statistic of interest is the sum of ranks assigned to the target-associated transcripts, lower values indicating better matches. For nine targets, for example, the sum of ranks could range from nine (for perfect matching) to eighty-one. The technique for calculating the probability that a given sum of ranks or less will occur by chance is given in Reference 1.

As an overall calibration of the remote viewing process, against which specific examples can be gauged, we can take as a background data base a lengthy collection of 51 remote viewing trials collected over a several-year period with nine subjects, and published by the authors in Ref. 1. In these trials subjects were targeted on local targets (bridges, swimming pools, theaters, airports, computers, machine shops, etc.) within a 20 km range of SRI. The quality of the results was such that the judges, who had to determine in a blind fashion which subject-generated data packages (tape transcripts and drawings) were associated with which target sites, were able to blind match transcripts to targets in first place in roughly half the cases.



\* Except that statements which would cue a judge as to target order are removed (e.g., reference to a previous target).

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B. Experimenter Influences

From the work of Prof. Robert Rosenthal at Harvard it is clear that there is a strong difference in the outcome of some psychology experiments, depending on who conducts the experiment. This so-called experimenter effect has been the subject of investigation for the past 15 years in an attempt to find means to objectify some of the principal findings of conventional perceptual and behavioral psychology. We are not suggesting that this experimenter effect in psychology is due to paranormal influences, but rather that some of the inability to replicate ESP experiments of one laboratory, when the experiments are transferred to another laboratory, might be due to subtle experimenter effects of the type known to occur in psychology and behavior experiments in general.

We consider it important to find out if the success or failure of parapsychology experiments relate to the experimenter effect through interpersonal interaction, subliminal cueing, or some as-yet uncataloged factor. Rotation of experimenters and interchange of subject-experimenter roles can supply needed information on these factors. As of June 1978, Dr. Charles T. Tart, a well-known psychologist, has joined the program; one of his specific concerns is experimenter influence.

C. Educational Procedures

1. Screening



It is now generally agreed that psychic functioning is an innate or latent ability, somewhat similar to musical talent. That is, all people have it to some degree, but there is a wide range of abilities from the psychically tone deaf, to the virtuoso performer. It would be the goal of a screening program to locate and recruit the most psychically talented individuals available, both to obtain a measure of the range of abilities that exists, and also to make use of these abilities to further increase our understanding of

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the phenomenon. To build up an appropriate data pool psychological and neurophysiological profiling of subjects as a routine practice is indicated.

## 2. Training

### a. Training in Perceptual Tasks Paralleling Ordinary Perception

For our first attempt, we have carried out a series of communication experiments involving the transmission, from one laboratory to another, of simple shapes (e.g., T, O, Δ), which also were of different colors for each shape. These tests were initiated in an effort to assess reports of Soviet work in this area, which include the transmission of decimal numbers via a psychoenergetic channel, with a claimed yield of 105 out of 135 decimal digits 0-9 ( $p \sim 10^{-77}$ ).<sup>17</sup>

The communications series was designed to determine whether a gradient series of perception tasks that mimic the known development of ordinary perception would be useful in the development of paranormal perception. The decision to follow such a protocol was derived from data indicating that the laws of paranormal perception are congruent with, rather than skew to, the laws that govern ordinary perception, especially under conditions of subliminal presentation. The particular question examined was whether a specific perceptual orientation process known to hold in ordinary perception of color, would hold in the case of paranormal perception as well. The perceptual process of interest was the well-documented scale of increasing sensitivity to color tones. Cross-cultural studies of 98 separate linguistic stocks indicate that perception of color tones in the environment begins with discrimination first of black and white (dull/bright); then red is identified as a color; then yellow followed by green, or green followed by yellow; then blue, brown, and finally purple, pink, orange, and grey.<sup>18</sup>

With the hypothesis that a similar gradient is followed in the development of paranormal perception, subjects were asked to differentiate among simple remote color card targets first on the basis of the dichotomy dull/bright, then with regard to shape, and only finally with regard to color. Specifically, subjects were encouraged to reject premature mental discrimination processes based on color recognition, which, by the hypothesis under test, we would assume to be imaginative overlay from the already highly developed ordinary perceptual modes.

Numerous data were gathered with two subjects who were experienced remote viewers. Analysis of the data, which is suggestive of learning, provides initial support for the hypothesis that progress in paranormal perception can be made on the basis of training drills designed from what is known about ordinary perception.

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The purpose of this kind of training is the development of excellent and reliable paranormal perception of analytic and other alphanumeric types of target material.

Two extensions of this work are proposed: (1) Novice, as opposed to experienced, subjects will be tested on the protocol established above to determine whether they also show improvement in remote perception skills; and (2) additional protocols based on factors known to be important in ordinary perception will be designed and evaluated by further testing with experienced subjects.

b. Training in Abstract Targeting, Including Geographical Coordinates

To date, two subjects have unmistakably demonstrated their ability to describe distant locations, given only the map coordinates (latitude and longitude) of a target site. Other subjects have attempted similar tasks with mixed results.

One notable difference between the two groups is that the successful group ran through practice training procedures involving ~100 sites taken from an ordinary atlas. Therefore, it is proposed that a similar procedure be applied with new subjects to evaluate whether such a procedure might result in the development of a training protocol of general use. Should improvement be forthcoming on this basis, novice subjects would also be tested and evaluated utilizing the same protocols.

Additional variations on the theme of abstract targeting would include targeting on the basis of pictures or maps of the target site (with and without key elements missing).

The goal of these efforts is to evaluate potential training protocols of wide applicability. Should such a program be successful, it would eliminate our dependence on a select group of naturally gifted individuals, a group that is inadequate in number for large-scale exploration of the field's potentialities.

c. The Ten-Choice Numerical Training Facility

To date our experiments have generally indicated that subjects show more psi functioning with natural setting/pictorial/solid targets than numerical targets, yet numbers and quantities are an important kind of information in the modern world. General parapsychological research over several decades has certainly demonstrated that subjects can use significant amounts of psi on numerical targets like cards, but these results, while highly significant statistically, have usually been at a very low absolute level above chance performance, such as averaging 52% instead of the chance-expected 50% in a binary

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calling task. Further, especially talented subjects, whose results were at a more practical level, have almost universally shown a long-term decline in performance with repeated testing, leading to eventual loss of psi ability.

These declines have been observed almost exclusively in testing situations that do not involve immediate feedback of results to the subjects, and this factor led both Charles Tart (Refs. 19-23) and Russell Targ (Ref. 24) to postulate that testing without feedback is an extinction paradigm of the sort psychologists routinely use to extinguish performance to chance levels. Thus the provision of immediate feedback to subjects who have some demonstrable psi ability to begin with should at least allow stabilization of psi ability in numerical tests and allow the more talented subjects to discover what sort of internal strategies for psi calling improve their performances. Thus highly talented subjects should eventually learn to improve their psi abilities with immediate feedback training.

Research to date on immediate feedback by the present investigators (Ref. 24), as well as others (summarized in Ref. 21), has generally found that (1) significant declines, the big problem in the field, are eliminated; (2) highly significant psi performance has been stabilized in some subjects; and (3) higher talented subjects show signs of learning improved psi performance. Research to date suffers from the drawback, however, that there has not been extensive training of talented subjects to test the ultimate psi performance available.

A Ten-Choice Numerical Training Facility just set up at SRI, modeled on a Ten-Choice Trainer developed at Tart's laboratory at the University of California at Davis, is designed to allow us to investigate the parameters of immediate feedback training in a psi task that is simultaneously numerical and spatial. The facility, the basis of which is a computerized ten-choice random number generator, occupies two laboratory rooms in separate buildings (to eliminate potential sensory cueing problems). The subject, acting as receiver, is seated in a comfortable room in an outbuilding adjacent to the main research building of the project. He sits before a console consisting of ten unit lamps arranged in a circle. There is a response button beside each lamp for the subject to register his choice. When a Ready signal lamp at the center of the circle comes on, the subject knows that an electronic random event generator in the computer controlling the experimenter/sender's console has chosen one of the ten lamps as a target. When the subject feels he has some idea as to what the correct target is, he presses the appropriate response button. The control computer immediately illuminates the correct target lamp, so the subject has immediate feedback as to whether he was right or wrong. If he was wrong, he also sees whether he was spatially close to the correct target or not, or whether he has consistent displacement patterns he might learn to correct. He can try various response strategies and decide, by virtue of the feedback, which ones work for him.

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Because some subjects treat this task as a spatial location task, running their hand around the circle of unlit lamps and waiting for a "feeling" to tell them when they are over the correct one, a closed circuit TV camera monitors the subject's console so the experimenter/sender can monitor when the subject is "hot" or "cold." While the console in the subject's facility is designed so that no relevant information is present in the room, this spatial scanning behavior is quite important to some subjects as a "read-out device" for their psi impressions, and it also gives the experimenter/sender immediate feedback on the success of his "sending" technique, so he has a chance to improve also.

The facility is computer controlled by a dedicated micro-computer, which automatically stores target and response data for later detailed analysis, including sophisticated time displacement analyses for study of the trans-temporal inhibition mechanism for enhancing psi performance discovered in earlier studies by Tart (Refs. 25-27). The experimenter/sender's console, controlling computer, and other recording apparatus are located in a separate building from the subject's room of the facility to eliminate all possible sensory cueing paths. Communication between experimenter/sender and subject is interlocked with the controlling computer. Free conversation over an intercom system is allowed between trials, when data on the previous trial have already been stored and the target for the upcoming trial has not yet been selected by the electronic random event generator; we feel such communication about response strategies, etc., is important in the early phases of training. Simultaneously with a target being selected, however, the intercom is automatically disabled, to prevent any inadvertent cueing of the subject by the experimenter/sender.

It is important to note that the Ten-Choice Numerical Training Facility is just that, a training facility. Once a subject has learned to recognize and volitionally generate psi-favorable mental conditions with the immediate feedback provided in training, we expect to be able to wean him from the Training Facility so that he can continue to use high level psi in other settings where high experimenter/sender participation and immediate feedback are not available.

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### III OBJECTIVES

Based on our own past six years of research, and the decades of investigation by other scientists, we conclude that present evidence strongly indicates the existence of some sort of paranormal or psycho-energetic perceptual channel.

The two underlying goals that must be attained for the eventual utilization of this phenomenon are reliability and understanding, and the recognition that it is necessary to have both in order to have either.

We recommend that the principal objective of this program involve the optimization of the experimental protocols, and the training of subjects to reach excellence of performance. In addition, screening procedures must be established to enlarge the populations from which subjects are drawn, to allow us to find additional gifted individuals for participation in the experimental program.

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**IV STATEMENT OF WORK**

The overall goal of this project is the training of four individuals from the client organization for participation in remote viewing experiments, as both subjects and experimenters. To achieve this goal, four separate activities will be undertaken.

- (1) In the first month of this contract, a senior observer from the client organization will visit SRI for a one- to two-week period for the purpose of evaluating past data on hand, observing experiments in progress, taking part in remote viewing experiments as subject, and, as a monitor, conducting experiments with other subjects. Relevant data, protocols, and procedures will be made available to the client's representative to enable him to reach informed conclusions about the remote viewing activity and methods for conducting similar activities himself in a different location of his choosing.
- (2) In April, May, and June of 1979, three additional individuals will take part in intensive training activities at SRI for one month each. Again, these individuals will learn to be subjects and to carry out experiments themselves. Relevant training techniques and materials developed to date will be made available to them for this purpose.
- (3) Dr. Ralph Kiernan, Department of Neurology, Stanford University Medical Center, a consultant on the Radio Physics Laboratory projects on extended perception, is involved in a long term project to attempt the identification of neurophysiological correlates of individuals possessing enhanced capabilities in the areas of interest. The function to be served by Dr. Kiernan is the administration of various tests (speech perception tests, Buschke memory tests, verbal concept attainment tests, Wechsler Adult Intelligence Scale, etc.) which yield information of neurophysiological and neuropsychological functioning and which may be of use in establishing profiles for good subjects.

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(4) Each of the training program participants will carry out a minimum of 250 trials with the Ten-choice Numerical Training Facility to provide a calibration on ability to identify numeric characters by remote viewing. The data will be analyzed to detect success/failure strategies, trends in learning ability, and so forth. The results of such analysis will be provided to the client.

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V REPORTING SCHEDULE

Quarterly progress letters describing the work completed and financial details will be delivered on the tenth day following the end of each quarter after the commencement date of the contract. A final report will be delivered at the end of the 12th month after the commencement date of the contract.

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## VI QUALIFICATIONS OF SRI

SRI is an independent, nonprofit organization performing a broad spectrum of research under contract to business, industry, and government. The institute, which was formerly affiliated with Stanford University, was founded in 1946. Its operations include the physical and life sciences, industrial and development economics, management systems, engineering systems, electronics and radio sciences, information science, urban and social systems, and various combinations of disciplines within these fields.

SRI has no endowment; payments by clients under research contracts and grants amount to approximately \$100 million annually and are used to cover all operating costs. Such revenue also helps the Institute maintain the excellence of its research capabilities.

SRI's facilities include more than one million square feet of office and laboratory space and incorporate the most advanced scientific equipment, including unique instrumentation developed by the staff. The bulk of these facilities and most of the research staff are located at the Institute's headquarters in Menlo Park, California. Regional office locations include Washington, D.C.; New York City; Chicago; Houston; and Los Angeles.

Of SRI's total staff of 3000, approximately one-half are in professional and technical categories. Some 450 members of the professional staff have Ph.D. or equivalent degrees; 600 others have their master's degree.

The project leader and other research personnel who would be active on the proposed work are members of the Radio Physics Laboratory. This Laboratory employs a staff of 153 people, including 96 professional and 57 technical and clerical members. Of the professional personnel, 39 have Ph.D. degrees or equivalent, 5 other engineer's degrees, 25 have master's degrees, and 30 have bachelor's degrees.

Since its inception, the Radio Physics Laboratory has undertaken basic research for various branches of the U.S. Government. Laboratory personnel have participated in theoretical and experimental studies of ELF through UHF electromagnetic propagation, including ionospheric, atmospheric, surface-wave, underground, and underwater propagation. They have performed extensive mathematical modeling and experimental studies of environmental effects on propagation, including scattering, noise, interference, EMP, and nuclear and ionospheric effects. A number of these programs have required the development, modification, and maintenance

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of sizable computer codes. The laboratory has also been concerned with the development, as well as performance evaluation and testing, of instrumentation relating to these areas of work.

The proposed research will be supervised by SRI staff members within the Radio Physics Laboratory under the direction of Dr. Robert S. Leonard. The principal investigators will be Dr. Harold Puthoff and Mr. Russell Targ. Our consultant, Dr. Charles Tart, will also participate in this program. Biographies are attached for these personnel.

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HAROLD E. PUTHOFF

Senior Research Engineer  
 Radio Physics Laboratory  
 Systems Research and Analysis Division

**SPECIALIZED PROFESSIONAL COMPETENCE**

Tunable laser research and development; quantum electronics, research in remote sensing and other psychoenergetic phenomena

**REPRESENTATIVE RESEARCH ASSIGNMENTS AT SRI (since 1971)**

Development of tunable ultraviolet laser source for pollution studies and medical research  
 Research and development of biofield measurements; investigation of "paranormal" perceptual abilities, psychoenergetic phenomena

**OTHER PROFESSIONAL EXPERIENCE**

Research associate, Hansen Laboratories of Physics, and lecturer, Department of Electrical Engineering, Stanford University: teaching, textbook author, research supervisor of Ph.D. candidates in the area of lasers and nonlinear optics, and development of high-power tunable infrared laser source (50-250 microns) for materials research  
 Consultant on applications of lasers to industrial and medical problems, Stanford University  
 Lieutenant, USNR: in-house research and contract monitoring on DoD (NSA) contracts concerned with the development of ultra high-speed (GHz) computers, assessment of potential of fiber optics and lasers for use in optical computers  
 Research engineer, Sperry Electronic Tube Division, and Sperry fellow, University of Florida: design and testing of electron-beam focusing systems for use in microwave tubes

**ACADEMIC BACKGROUND**

B.E.E. (1958) and M.S.E. (1960), University of Florida; Ph.D. in electrical engineering (1967), Stanford University

**PUBLICATIONS AND PATENTS**

Coauthor of textbook, Fundamentals of Quantum Electronics (Wiley) published in English, French, Russian; author or coauthor of more than twenty-five papers in professional journals on electron beam and laser research; more recently, first major publications of research on psychoenergetic phenomena: "Information Transfer Under Conditions of Sensory Shielding," Nature (Oct. 1974) and "A Perceptual Channel for Information Transfer over Kilometer Distances," Proc. IEEE (March 1976); coauthor of Mind Reach: Scientists Look at Psychic Research (Delacorte Press, New York, 1977)

**PROFESSIONAL ASSOCIATIONS AND HONORS**

American Association for the Advancement of Science; American Physical Society; Institute of Electrical and Electronics Engineers; Phi Eta Sigma; Phi Kappa Phi; Sigma Tau; Sigma Xi

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RUSSELL TARG

Senior Research Physicist  
Radio Physics Laboratory  
Systems Research and Analysis Division

SPECIALIZED PROFESSIONAL COMPETENCE

Development of high-power gas lasers; FM laser and supermode laser techniques; optical modulation and demodulation; microwave diagnostic techniques; microwave generation from plasmas; research in remote sensing and other psychoenergetic phenomena

PROFESSIONAL EXPERIENCE

Sylvania Corporation; investigation of techniques for development of new gas lasers, making use of research with compact, self-contained multikilowatt CO<sub>2</sub> lasers

Technical Research Group; experiments in new gaseous laser media  
Polytechnic Institute of Brooklyn; assisted in the establishment of Electron Beam Laboratory

Sperry Gyroscope Company, Electron Tube Division; experimental work in microwave generation from plasmas; early work in the technology of ultrahigh-vacuum and ion-pump design.

ACADEMIC BACKGROUND

B.S. in physics (1954), Queens College, New York; graduate work in physics (1954-56), Columbia University

PUBLICATIONS AND INVENTIONS

Author or coauthor of more than thirty articles on lasers and plasma research, and more recently, the first major publication of research on psychoenergetic phenomena in Nature and in the Proceedings of the IEEE: "Information Transfer Under Conditions of Sensory Shielding," Nature (October 18, 1974) and "A Perceptual Channel for Information Transfer over Kilometer Distances," Proc. IEEE (March 1976)

Coauthor of Mind-Reach: Scientists Look at Psychical Research (Delacorte Press, New York, 1976)

Invention of the tunable plasma oscillator at microwave frequencies

PROFESSIONAL ASSOCIATIONS AND HONORS

Senior Member IEEE; American Physical Society; President and cofounder of Parapsychology Research Group, a tax-exempt California corporation since 1963, with research and educational objectives in the area of psychic functioning

Research associate with the Polytechnic Institute of Brooklyn

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**CHARLES T. TART -- SHORT CURRICULUM VITA**

Charles T. Tart is a Professor of Psychology at the University of California, Davis, currently on leave and acting as a Consultant to SRI. He received his doctoral degree in psychology from the University of North Carolina in 1963, after previous study of electrical engineering and psychology. He taught and conducted research at Stanford University and the University of Virginia School of Medicine before accepting his current position.

Professor Tart has conducted research in sleep, dreaming, hypnosis, psychedelic drugs, and parapsychology, with his research activities currently being focused in the areas of altered states of consciousness, transpersonal psychology, and experimental parapsychology, a concern with the unrealized potentialities of man.

Professor Tart's scientific publications include the following books: Altered State of Consciousness (Wiley, 1969 and Doubleday, 1972); Transpersonal Psychologies (Harper & Row, 1975); States of Consciousness (Dutton, 1975); The Application of Learning Theory to ESP Performance (Parapsychology Foundation, 1975); and Learning to use Extrasensory Perception (University of Chicago Press, 1976) as well as more than one hundred scientific articles and papers in journals such as Science and Nature as well as more specialized journals.

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